

**Methods** Personal sampling of welding fumes was carried out in 241 welders. Ninety respirable dust measurements were below the limits of detection (LOD). Therefore, we applied Tobit regression and imputations of values below LOD according to the log-normal distributions of the data  $\geq$ LOD with maximum likelihood estimation. We estimated regression coefficients for the welding processes, protective measures, and other factors.

**Results** Main determinant of the concentrations was the type of welding process. The use of flux-cored wire in gas metal arc welding was estimated to increase the concentration in comparison with gas metal arc welding with solid wire (GMAW) by a factor of 2.20 (95% CI 1.58 to 3.06) using Tobit regression and by 2.36 (95% CI 1.51 to 3.69) using imputation. Tungsten inert gas welding was associated with 0.15 fold lower levels than with GMAW in both models. Dust extraction reduced the concentrations, whereas welding in confined space increased exposure levels with significant effects in both approaches.

**Conclusions** Exposure to respirable welding fumes was frequently found below LOD. Two different approaches to deal with data  $<$  LOD, Tobit regression and imputation, revealed similar effect estimates for the welding process and other influencing factors on the concentrations of welding fumes.

## WELDING FUME EXPOSURE AND DETERMINANTS IN GERMAN MALE WELDERS

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**Objectives** The aim of this analysis was to explore exposure to welding fumes and potential influencing factors of the airborne concentrations.